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SUBJECT: Comments on Docket No. RCRA-2002-0033 - *Evaluating the Vapor Intrusion to Indoor Air Pathway From Groundwater and Soils*

Greetings,

Attached please find comments on the November 2002 USEPA document *Evaluating the Vapor Intrusion to Indoor Air Pathway From Groundwater and Soils* (Docket No. RCRA-2002-0033). While we find the methodology presented in the document to be very timely and useful, we are concerned that certain aspects of the guidance are both excessively over protective (e.g., groundwater screening levels) and under protective (e.g., OSHA PELs) and not useful for screening purposes.

I look forward to the final version of the guidance. Please contact Roger Brewer of my staff at (510) 622-2374 [e-mail rdb@rb2.swrcb.ca.gov] if you have any questions.

Sincerely,

Stephen A. Hill
Toxics Cleanup Division Chief

Attachment: Comments on Docket No. RCRA-2002-0033

cc with attachment:

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Comments on Docket No. RCRA-2002-0033 - *Evaluating the Vapor Intrusion to Indoor Air Pathway From Groundwater and Soils*

1. **Section III.C, Tier 2 - Secondary Screening: Clarify the use of the indoor-air screening levels with respect to short-term and long-term exposure.** Models may predict initial indoor-air impacts above target goals (e.g., first ten years) but decreasing impacts over time and ultimately a 30-year average impact below the goals. Should this be considered adequate or should the indoor-air goals be used as "never-to-exceed" values? Clarify what steps should be taken when indoor air goals are exceeded (e.g., continued monitoring; remediation required, vacate building immediately, etc.). This information will be very helpful to users of the document. The USEPA Region IX office is also developing specific approaches to address this issue (contact Patrick Wilson, wilson-patrick@epamain.epa.gov).
2. **Section I.D; Occupational Setting: Develop risk-based screening levels for indoor air and soil gas for occupational settings impacted by offsite releases.** OSHA Permissible Exposure Levels (PELs) for indoor air are intended for use in industrial settings where employees are aware of potential health hazards associated with the specific chemicals they are using and are trained to take proper precautions. OSHA PELs are not appropriate for evaluation of commercial/industrial properties that have been impacted by offsite releases, however, or for facilities that are not currently using the subject chemical(s). Risk-based screening levels for indoor air under a commercial/industrial setting (generally lower than OSHA PELs) should instead be applied to these sites.

In one example from the San Francisco Bay area, releases of TCE from a freeze-drying facility led to a plume of contaminated groundwater that extends more than 3,000 feet downgradient from the site. Even though impacts to indoor air at the facility were primarily due to emissions from contaminated soil and groundwater under the building, OSHA indoor-air goals could feasibly be applied to assess the scope of remedial actions needed. Immediately downgradient of the site is a warehouse that stores and potentially uses TCE. OSHA indoor-air goals could again potentially be applied to this facility (see also last paragraph).

Further downgradient of the release area is a fire station and as well as other businesses that do not use TCE. In these areas, risk-based screening levels for indoor air are applied and used to determine appropriate remedial actions, not OSHA PELs. Oversight of the investigation and assessment of potential impacts to indoor air in these areas (as well as the rest of the plume) is carried out by the California EPA (Regional Water Board, not California OSHA). OSHA personnel in general do not have experience in the evaluation of contaminated soil and groundwater and have no legal authority to impose cleanup requirements at sites impacted by offsite releases.

In the above example, the freeze-drying facility is no longer in operation. The building is now used for warehouse purposes that do not include the use or storage of TCE. OSHA PELs therefore no longer apply. Final cleanup actions at the site were based on the

protection of indoor air with respect to risk-based goals for occupational settings. It is important to note that use of PELs for final cleanup goals would also have placed a significant future restriction on use of the building. If TCE-based activities had ceased in the future, the OSHA PELs would have no longer been applicable and additional remediation would likely have been required for continued use of the site. In practical terms, OSHA PELs should never be used to develop final cleanup goals for a site, although they may be useful on an interim basis.

It should also be noted that the current OSHA PEL for TCE is 678,000 ug/m³ (100 ppmv, NIOSH web page: <http://www.cdc.gov/niosh/npg/npg.html>). Based on the CalEPA inhalation slope factor of 0.007 (mg/kg-day)⁻¹, this correlates to a chronic, excess cancer risk of one-in-three for unprotected workers under a standard, long-term exposure scenario (i.e., one in three workers exposed to this level of TCE in indoor air over twenty-five years can be expected to develop cancer). Based on the recent, draft USEPA slope factor of 0.40 (mg/kg-day)⁻¹, the PEL correlates to an excess cancer risk of greater than one-in-one (i.e., 100% of workers would be expected to develop cancer). The PEL also exceeds the indoor air goal for noncarcinogenic effects of 10 ug/m³ by a factor of greater than 50,000, suggesting potentially severe systemic health effects over even short exposure durations.

2. **Section III-C; Target Hazard Quotient: Use a target hazard quotient of 0.2 (vs 1.0) to develop screening levels.** Indoor air, soil gas and groundwater screening levels for noncarcinogenic health effects are based on a target Hazard Quotient of 1.0. USEPA generally recommends that a Hazard *Index* of 1.0 not be exceeded when evaluating contaminated sites. This takes into account potential cumulative effects of chemicals with similar health effects. Most solvent and petroleum release sites in the San Francisco Bay area contain up to three or more VOCs, including breakdown products of primary chemicals (e.g., PCE, TCE, cis and trans DCE, vinyl chloride, etc.). Assuming a target Hazard Index of 1.0, the use of screening levels based on a Hazard Quotient of 1.0 for individual chemicals to assess potential health impacts at these sites is not adequately conservative. Suggesting that this can be addressed in a more site-specific risk assessment when more than one VOC is present negates the usefulness of the screening levels, since this will be the case at a majority of sites. Use of a target Hazard Quotient of 0.2 (i.e., assumes up to five VOCs with similar health effects) to develop screening levels helps ensure that potential cumulative health effects are addressed up front and expedites completion of the screening level risk assessment. A modification of the screening levels will only be required at the relatively few number of sites where more than five VOCs with similar health effects are present.
3. **Tables 2 and 3, Appendix D; Groundwater Screening Levels: Develop alternative model for development of groundwater screening levels that reflects a more rigorous model and, ideally, reflects a more substantial evaluation of paired groundwater and indoor-air data. Do not use drinking water MCLs as "caps" for screening levels.** The RWQCB is very concerned that formal presentation of the proposed groundwater screening levels could cause unwarranted concerns about potential indoor-air impacts in the San

Francisco Bay area. Agencies in California, including the RWQCB, typically use a target excess cancer risk of 10^{-6} for potential human health concerns under a residential exposure scenario. At this target risk, the risk-based screening levels for PCE, TCE, vinyl chloride and benzene are 0.11 ug/L, 0.05 ug/L, 0.25 ug/L and 1.4 ug/L, respectively (based on goals for 10^{-4} target risk in Table 2a and ignoring the MCL cap; see below). Although our review of existing data is still underway, we do not know of any site in the Bay Area where emissions from groundwater contaminated two orders of magnitude or more above the presented screening levels clearly led to indoor-air impacts above the correlative target goals for indoor air.

The OSWER document uses a 1,000-fold attenuation factor for "source area soil gas" to indoor air to develop groundwater screening levels for potential indoor-air concerns. From our understanding of the document, this is not based on an evaluation of correlative groundwater, soil gas and indoor air data, as would be most appropriate. Instead, the model attenuation factor is based on two important assumptions: 1) Soil gas data collected at the study sites are representative of maximum VOC concentrations in the capillary fringe "source area" and 2) VOCs in soil gas immediately above the groundwater are in theoretical equilibrium with dissolved-phase VOCs in groundwater. Neither of these assumptions are substantiated by data presented or referenced in the document. We suspect that one or both of the assumptions are not valid for the data set used to develop the model. This needs to be further evaluated..

The OSWER document acknowledges the likely over-conservative nature of the groundwater screening level model by incorporation of a cap based on drinking water MCLs. The use of MCLs to mask doubts about the accuracy of the model is clearly not appropriate, however. We recommend two alternative options:

- 1) Use the Johnson & Ettinger groundwater-to-indoor air model to back-calculate conservative groundwater screening levels and/or
- 2) Delete groundwater screening levels for indoor-air impact concerns in the document until such time that a more substantial compilation and review of field data can be carried out.

Until a significantly larger database can be compiled and reviewed, the use of assumed source vapor-to-indoor-air attenuation factors to develop groundwater screening levels for potential indoor air concerns should be discontinued.

4. **Section V-2; Consideration of Advective Flow:** Clarify that the screening levels are applicable to sites where low or moderate advective flow of subsurface vapors may be occurring. The RWQCB requires that moderate advective flow of subsurface vapors be assumed in indoor-air impact models. Section V-2 of the OSWER guidance implies that the model used to develop the screening levels is based on an assumption of diffusive transport of subsurface vapors only and that the screening levels are not applicable (i.e., may be under

conservative) where moderate advective flow is occurring. A default vapor flow rate of 5 L/minute is incorporated into the OSWER model, however (Appendix G). This is correlative to advection-induced vapor flow rates predicted by the Johnson & Ettinger model for very permeable sands and a moderate indoor/outdoor air pressure differential (*User's Guide For The Johnson and Ettinger (1991) Model For Subsurface Vapor Intrusion Into Buildings* (2000)). The USEPA document specifically recommends use of a default indoor/outdoor pressure differential of 4 Pascals (40 g/cm-s^2). In models used by the RWQCB to develop soil and groundwater screening levels for indoor-air impacts, this leads to an advection-induced vapor flow rate of 4.6 L/minute.

5. **Question 5, Appendices D, F and G; Use of Johnson & Ettinger Model: Provide a more detailed discussion of the derivation of the attenuation factors presented in Figures 3a and 3b.** Derivation of graph presented in Figure 3b is not adequately described in the appendices. Raw data from sites used to generate this graph (and others in the document) should be provided in an appendix. Reference to Appendix D should presumably be made in the Question 5/Part 3 text in place of or in addition to Appendix G. At a minimum, provide the equations and/or example spreadsheet printouts and reference to supporting documents (e.g., assuming use of the Superfund spreadsheets). Summarize all input parameter values. Do not mix input values (e.g., crack width) with values calculated by the spreadsheet (e.g., Crack to Total Area Ratio).

Question 5/Part 3, Appendix D states that groundwater screening levels account for transportation across the capillary fringe. There is no discussion of this in Appendix G. Appendix D implies that the groundwater screening levels were back calculated from soil gas screening levels that do not address this issue. Section 7 of Appendix D simply states that "Diffusion resistances across the capillary fringe are assumed to be accounted for in the value of (alpha)." Transportation across the capillary fringe either was or (seemingly) was not included in the models. This needs to be clearly discussed.

Clearly state that attenuation values presented in the Table 3 series were selected to cover the range of potential values calculated in Figure 3b. "Depth to Contamination" in Figure 3b presumably refers to "Depth to (Contaminated) Groundwater" but this is not clear.

The default Crack Ratio noted in Section 3.2 for basements should presumably be 0.00038 as stated in Table G-3. In the same table, it is unclear why parameter values for "Depth to Basement Foundation" and "Building Foundation Slab Thickness" are different (0.15cm vs 0.10cm). The use of "Subsurface Foundation Area" vs "Building Footprint Area" is also unclear.